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THE SELECTION EFFECT OF TWO-WAY TRADE IN THE MELITZ MODEL: AN ALTERNATIVE APPROACH

*Jacques POTIN**

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* ESSEC Business School, Department of Economics, Avenue Bernard Hirsch, BP 50105, 95021 Cergy Pontoise Cedex, France, tel: (33) 1-3443-3089, fax: (33) 1-3443-3001. E-mail : potin @essec.fr

**THE SELECTION EFFECT OF TWO-WAY TRADE IN THE MELITZ MODEL:
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<u>ABSTRACT:</u>

This paper studies the influential Melitz model of trade with heterogeneous firms using an alternative, intuitive approach. Contrary to what is often argued, it is an increase in product market competition that drives the bad firms out: with two-way trade, entry by foreign firms is not compensated by a "sufficient" reduction in the mass of surviving firms. To illustrate this, we decompose the total effect of trade in two partial effects: a domestic-profit-reducing effect due to foreign market penetration by the most productive firms; an average-profit-reducing effect due to the payment of the fixed export costs. We also provide the new prediction that trade generally leads to (weakly) less entry in the industry. This
clarifies key interpretation issues in a prolific literature.

Key-Words:

- Firm Heterogeneity
- Intra-industry Trade
- Selection

<u>RESUME :</u>

Ce papier propose une approche intuitive du très influent modèle de commerce international avec firmes hétérogènes proposé par Melitz. Contrairement à ce qui est souvent écrit, c'est une concurrence accrue sur le marché des produits qui fait sortir les firmes les moins productives : avec commerce bilatéral, l'entrée par les firmes étrangères n'est pas compensée par une réduction "suffisante" de la masse de firmes qui survivent. Afin d'illustrer ce phénomène, nous décomposons l'effet total du commerce en deux effets partiels : un effet "réduction du profit domestique" dû à l'entrée des firmes les plus productives sur les marchés étrangers ; un effet "réduction du profit moyen" dû au paiement des coûts fixes d'exportation. Nous prouvons également qu'une ouverture du commerce amène à moins d'entrée dans l'industrie. Nos résultats clarifient des points importants dans une littérature en plein développement.

Mots-clés :

- Commerce intra-industriel
- Hétérogénéité des firmes
- Sélection.

JEL Classification : F10 ; F12

The selection effect of two-way trade in the Melitz model: an alternative approach*

Jacques Potin †

April 7, 2009

Abstract

This paper studies the influential Melitz model of trade with heterogeneous firms using an alternative, intuitive approach. Contrary to what is often argued, it is an increase in product market competition that drives the bad firms out: with two-way trade, entry by foreign firms is not compensated by a "sufficient" reduction in the mass of surviving firms. To illustrate this, we decompose the total effect of trade in two partial effects: a domestic-profit-reducing effect due to foreign market penetration by the most productive firms; an average-profit-reducing effect due to the payment of the fixed export costs. We also provide the new prediction that trade generally leads to (weakly) less entry in the industry. This clarifies key interpretation issues in a prolific literature.

Keywords: intra-industry trade, firm heterogeneity, selection.
JEL classification: F12

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†ESSEC Business School, France. *Address:* ESSEC Business School, Department of Economics, Avenue Bernard Hirsch, 95021 Cergy Pontoise, France, *tel:* (33) 1-3443-3089, *fax:* (33) 1-3443-3001, *E-mail address:* potin@essec.fr.

1 Introduction

The paper by Melitz (2003) is one of the most influential in the recent trade literature. He extends the Krugman (1980) model by introducing productivity differences across firms. Only the firms with a productivity level above an endogenously determined cutoff can survive. This cutoff tends to increase when the countries open up to two-way trade: this is the first selection effect of trade. In the model, only the firms that are sufficiently productive decide to enter the foreign markets: this is the second selection effect of trade. Melitz (2003) shows that, through these selection effects, trade leads to aggregate productivity gains that raise welfare. The importance of the seminal work is an invitation to provide more intuition about what drives the main results.

In its first contribution, this paper explains the (first) selection effect of trade with an approach that is arguably more intuitive than Melitz's. While the original approach has become standard, it shows *why* the low productivity firms *have to be* driven out the industry, but it does not show explicitly *how* the bad firms *are* driven out of the industry. Instead, we explain intuitively and illustrate graphically the selection effect of trade. This leads us to significantly qualify the explanation provided by Melitz (2003, Section 7.2).

Our starting point is simple. With C.E.S. preferences and monopolistic competition, the mark-ups remain unchanged after the opening to trade.[1] Thus, as the low productivity firms only sell on their domestic market, their profits change if and

[1]See Melitz and Ottaviano (2008) for a model where trade has an impact on the "toughness" of competition, i.e. on the mark-ups.

only if they sell lower volumes on that market, which happens if the domestic ideal price index goes down. Thus trade drives the bad firms out if and only if entry by foreign firms is not compensated by a sufficient decrease in the number of producers. This point is implicit in the existing literature. Here we make it explicit and, more importantly and originally, we show and illustrate the exact mechanism at play.[2]

As highlighted by Melitz (2003, Section 5), the fixed export costs are crucial in his model. The present paper shows that it is fruitful to disentangle the total impact of these costs. First, they generate self-selection into export markets. Second, they reduce the profits of the exporters. Each of these partial impacts affects one of two equilibrium conditions involving the productivity cutoff for survival, φ^*, and the mass of surviving firms, M. The first of these conditions is the free-entry (FE) condition: it states that the net value of entry should be equal to zero. The second condition is the zero-profit (ZP) condition: it states that the active firms with the lowest productivity should just break even.

First, self-selection into export markets has a *domestic-profit-reducing effect* that affects only the (ZP) condition: entry by foreign firms reduces each firm's domestic profit and the total profit of each low productivity firm (because such a firm chooses not to export). For the productivity cutoff for survival, φ^*, to remain unchanged, a sufficient decrease in M is required; or, alternatively, for any given M, a corresponding increase in φ^* is required. When we ignore the impact of the fixed export costs on the exporters profits, we find that foreign market entry by the most pro-

[2] Since Melitz (2002), it is also well understood that moving from autarky to a situation with imports only would have no impact on the productivity cutoff. The export opportunities are therefore crucial. But our focus here is on the *total effect of two-way trade*.

ductive firms has no effect on the average profit (for any M), and thus no effect on the (FE) condition: the variable profits made on the foreign markets just compensate the losses on the domestic markets. Letting φ^* and M vary, we find that this domestic-profit-reducing effect induces an increase in φ^* and a decrease in M.

Second, the fixed export costs reduce the profits of the exporters, thus the average profit made by the active firms. The (FE) condition is modified by this *average-profit-reducing effect*. On the other hand, the (ZP) condition is unchanged because it is specific to firms that decide not to export. This change in the (FE) condition induces an additional decrease in M and mitigates the increase in φ^*: as proved by Melitz (2003), moving from autarky to two-way trade induces exit by the least productive firms.

In a second contribution, we provide the new prediction that, under specific conditions, moving from autarky to two-way trade generally leads to (weakly) less entry in the industry.

With its new approach and prediction, this paper clarifies key interpretation points in the Melitz (2003) paper. First, it is a decrease in the ideal price index that drives the bad firms out. It has no effect on the mark-up, but it has negative effects on the domestic sales of all firms. The (first) selection effect of trade is thus due to what should be called an increase in product market competition rather than an increase in labor market competition (as may be understood in Melitz, 2003, Section 7.2).[3] Second, it might be wrongly inferred from Melitz (2003, Section 7.2) and Bernard, Redding, and Schott (2007, Sections 1 and 5.1) that, in the

[3]This explanation is repeated in most Ph.D.-level lecture notes available on the internet (at the time the present paper is written).

Melitz model, moving from autarky to two-way trade leads to more entry in the industry, thereby raising competition on the labor (Melitz) or product (Bernard *et al.*) markets and reinforcing the selection effect of trade. In fact, moving from autarky to two-way trade generally reduces entry in the industry. It does raise product market competition, but the actual mechanism is that entry by foreign firms is not compensated by a corresponding reduction in the mass of active firms.

In Section 2, this paper studies the equilibrium in a closed economy. Then, in Section 3, it studies the equilibrium with costly trade, and compares the latter equilibrium with the one obtained for the closed-economy case. We finally conclude.

2 Equilibrium in a closed economy

2.1 Setup of the model

A representative consumer maximizes a C.E.S. utility function. The elasticity of substitution across goods is $\sigma > 1$. The aggregate expenditure is R.

To enter the industry, a firm must employ $f_e > 0$ workers during one period. The firm then draws its productivity parameter φ from a common distribution $g(\varphi)$ with a positive support over $(0, \infty)$ and a continuous cumulative distribution $G(\varphi)$. Labor requirement is given by $l = f + q/\varphi$, with f identical across firms. Upon entry, a firm may decide to exit the industry. If it decides to produce, it faces a probability of death δ in each period.[4] There is no time discounting, and there is monopolistic competition. We restrict our analysis to the stationary equilibria and discuss only the fundamental forces that bring about the long-run effects of trade.

[4]With these assumptions, Melitz (2003) builds on Hopenhayn (1992).

2.2 Individual profits

In autarky, the stationary distribution of firms is truncated at a zero-profit cutoff φ_a^*.[5] All firms with $\varphi < \varphi_a^*$ would make negative profits if staying in the industry and thus voluntarily decide to exit. We normalize the wage rate w to one. Optimal pricing leads to $p(\varphi) = \frac{\sigma}{(\sigma-1)\varphi}$. Following Melitz (2003), let us define $\tilde{\varphi}(\varphi_a^*) \equiv \left(\int_{\varphi_a^*}^{\infty} \varphi^{\sigma-1}\mu(\varphi)d\varphi\right)^{\frac{1}{\sigma-1}}$, where $\mu(\varphi) \equiv \frac{g(\varphi)}{1-G(\varphi_a^*)}$. Conditional on the mass of active firms M_a and the cutoff productivity level φ_a^*, a firm with productivity φ makes profits given by

$$\pi(\varphi|\varphi_a^*, M_a) = \frac{R}{\sigma}\left(\frac{p(\varphi)}{P(\varphi_a^*, M_a)}\right)^{1-\sigma} - f,$$

where $P(\varphi_a^*, M_a) \equiv \left(\int_{\varphi_a^*}^{\infty} p(\varphi)^{1-\sigma} M_a \mu(\varphi)d\varphi\right)^{\frac{1}{1-\sigma}} = M_a^{\frac{1}{1-\sigma}} p(\tilde{\varphi}(\varphi_a^*))$. With free entry, the net value of entry is zero in equilibrium, and total expenditures are equal to labor income ($R = L$). We find

$$\pi(\varphi|\varphi_a^*, M_a) = \frac{L}{\sigma M_a}\frac{\varphi^{\sigma-1}}{\tilde{\varphi}(\varphi_a^*)^{\sigma-1}} - f.$$

The profit of a firm depends positively on its productivity, and negatively on the mass of firms supplying goods and on the weighted average productivity of these firms.

2.3 Determination of the zero-profit cutoff

As a firm's profit is increasing in its productivity, the truncation point φ_a^* is in fact the zero-profit cutoff such that

$$\pi(\varphi_a^*|\varphi_a^*, M_a) = \frac{L}{\sigma}\left(\frac{p(\varphi_a^*)}{P(\varphi_a^*, M_a)}\right)^{1-\sigma} - f = 0 \Leftrightarrow \frac{L}{\sigma M_a}\frac{\varphi_a^{*(\sigma-1)}}{\tilde{\varphi}(\varphi_a^*)^{\sigma-1}} - f = 0. \quad (1)$$

[5] When some values are specific to the closed-economy equilibrium, we use the subscript a.

This condition can be rewritten

$$f[k(\varphi_a^*)+1] = \frac{L}{\sigma M_a} \qquad (ZP_a) \tag{2}$$

where $k(\varphi) \equiv \left(\frac{\tilde{\varphi}(\varphi)}{\varphi}\right)^{\sigma-1} - 1$. The right-hand side of this equation is decreasing in M_a, and, as recalled by Melitz (2003), its left-hand side is decreasing in φ_a^* for many common families of distributions. With such distributions, an increase in M_a leads to an increase in φ_a^*: with a small number of firms in the industry, even the low productivity firms can survive; when firms become more numerous, the productivity threshold for survival goes up.

2.4 The free-entry condition

For the firms that stay in the industry, the average profit conditional on the mass of firms M_a and the truncation point φ_a^* is

$$\bar{\pi}_a(\varphi_a^*, M_a) = \pi(\tilde{\varphi}(\varphi_a^*)|\varphi_a^*, M_a) = \frac{L}{\sigma M_a}\left(\frac{\tilde{\varphi}(\varphi_a^*)}{\tilde{\varphi}(\varphi_a^*)}\right)^{\sigma-1} - f = \frac{L}{\sigma M_a} - f.$$

Conditional on M_a, the expected profit does not depend on φ_a^*. Intuitively, if the productivity cutoff goes up, then firms are on average more productive; the increase in individual profits due to the higher productivity is exactly compensated by the higher average productivity of the competitors.

With free entry, the expected net value of entry must be equal to zero:

$$[1-G(\varphi_a^*)]\frac{\bar{\pi}_a}{\delta} - f_e = 0 \Leftrightarrow \frac{L}{\sigma M_a} - f = \frac{\delta f_e}{1-G(\varphi_a^*)} \qquad (FE_a) \tag{3}$$

This equation indicates a negative relationship between the mass of active firms M_a and the productivity cutoff φ_a^*: when the mass of active firms increases, this lowers the average industry profits; for the free-entry condition to be satisfied, it must be that firms are more likely to survive, implying that φ_a^* must decrease.

2.5 Equilibrium in a closed economy

The equilibrium values for M_a and φ_a^* are determined by equations (2) and (3). Combining the two expressions, we get that the zero-profit cutoff must satisfy

$$f[1 - G(\varphi_a^*)]k(\varphi_a^*) = \delta f_e. \tag{4}$$

Figure 1 shows the autarky equilibrium (E_a) and the way it is determined. The equilibrium exists and is unique (Melitz, 2003, Appendix B.1).

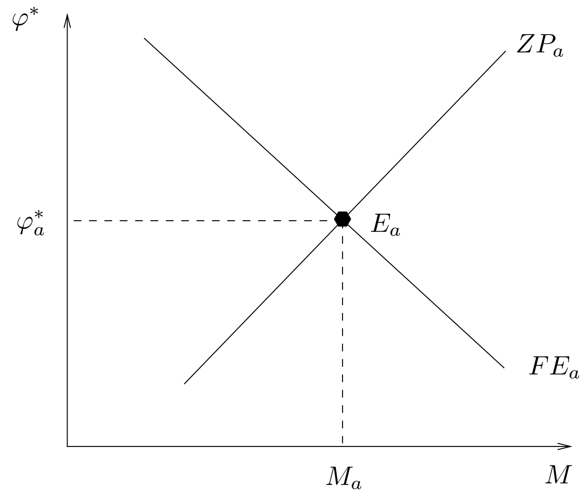

Figure 1: Determination of the equilibrium cutoff φ_a^* and mass of active firms M_a.

3 Equilibrium in the open economy

3.1 Costly trade

Following the opening of trade, the world is composed of $(n+1)$ identical countries. To sell abroad, firms must incur two additional costs: a per-unit iceberg transportation cost τ, and a fixed export cost whose amortized per-period portion is f_x. The latter cost is to be incurred for each destination market.

3.2 Individual profits

Optimal pricing for exports leads to a selling price on foreign markets of $p_X(\varphi) = \frac{\tau\sigma}{(\sigma-1)\varphi}$. With two-way trade, the stationary distribution of firms is truncated at a zero-profit cutoff φ_t^*. Let $\tilde{\varphi}(\varphi_x^*)$ be the weighted average productivity level of the exporting firms when the cutoff for exporting is φ_x^*. Following Melitz (2003), we define $\tilde{\varphi}(\varphi_x^*) \equiv \left(\int_{\varphi_x^*}^{\infty} \varphi^{\sigma-1} p_x \mu(\varphi) d\varphi\right)^{\frac{1}{\sigma-1}}$, with $\mu(\varphi) \equiv \frac{g(\varphi)}{1-G(\varphi_t^*)}$ and $p_x \equiv \frac{1-G(\varphi_x^*)}{1-G(\varphi_t^*)}$.

With trade, the profit of a firm on its domestic market is

$$\pi_d(\varphi|\varphi_t^*, \varphi_x^*, M_t) = \frac{R}{\sigma}\left(\frac{p(\varphi)}{P(\varphi_t^*, \varphi_x^*, M_a)}\right)^{1-\sigma} - f$$

$$\Leftrightarrow \pi_d(\varphi|\varphi_t^*, \varphi_x^*, M_t) = \frac{R}{\sigma M_t} \frac{\varphi^{\sigma-1}}{\tilde{\varphi}(\varphi_t^*)^{\sigma-1} + p_x n \tau^{1-\sigma} \tilde{\varphi}(\varphi_x^*)^{\sigma-1}} - f.$$

3.3 Determination of the zero-profit cutoff

As a firm's profit increases with its own productivity, the truncation point φ_t^* is the new zero-profit cutoff. Assuming that the active firms with the lowest productivity do not export and using $R = L$, we have

$$\pi_d(\varphi_t^*|\varphi_t^*, \varphi_x^*, M_t) = \frac{L}{\sigma}\left(\frac{p(\varphi_t^*)}{P(\varphi_t^*, \varphi_x^*, M_a)}\right)^{1-\sigma} - f = 0 \tag{5}$$

$$\Leftrightarrow \frac{L}{\sigma M_t} \frac{\varphi_t^{*(\sigma-1)}}{\tilde{\varphi}(\varphi_t^*)^{\sigma-1} + p_x n \tau^{1-\sigma} \tilde{\varphi}(\varphi_x^*)^{\sigma-1}} - f = 0$$

Comparing (1) and (5) shows that trade induces a change in φ^* if and only if it affects the price index, a measure of product market competition.[6] As p_x will be

[6] Normalizing the nominal wage w to one, the real wage is given by $1/P$: a change in the price index also induces a change in the real wage. But this change in the real wage is due to a change in the degree of product market competition.

positive, trade has no effect on φ^* if and only if entry by foreign firms is exactly compensated by "sufficient" exit.

Using $\varphi_x^*(\varphi_t^*) = \tau \left(\frac{f_x}{f}\right)^{\frac{1}{\sigma-1}} \varphi_t^*$ (equation (19) in Melitz, 2003), we get

$$f[k(\varphi_t^*) + 1] + p_x n f_x [k(\varphi_x^*(\varphi_t^*)) + 1] = \frac{L}{\sigma M_t}. \qquad (ZP_t) \tag{6}$$

The left-hand side of this equation is decreasing in φ_t^* for many common families of distributions. Thus, with such distributions, there is a positive relationship between M_t and φ_t^*. In the (M, φ^*) space, this relationship describes a (ZP) curve similar to the one for the autarky case, but shifted upward. In all countries, the most productive foreign firms enter and make the markets more competitive: this is the *domestic-profit-reducing effect* of the opening to two-way trade. As the low productivity firms do not export, it is harder for them to survive and φ^* tends to go up.

With a shift of the (ZP) curve only, we can determine an hypothetical long-run equilibrium (E') with φ^* higher and M lower than in the autarky equilibrium (E_a). How can we interpret this hypothetical equilibrium E'? Section 3.5 proves that, for any given M, imports and exports have effects on the average variable profit that exactly cancel off each other. Hence, due to the fixed export costs, two-way trade leads to a decrease in the average profit (for any given mass of firms) and, as we will see, to a shift of the (FE) curve. The hypothetical equilibrium E' therefore indicates the long-run equilibrium that would obtain if the fixed costs led to a domestic-profit-reducing effect, but not to an average-profit-reducing effect. As Figure 2 shows, foreign market penetration by the most productive firms induces exit by the least productive firms and a decrease in the mass of firms. The fixed export costs are here crucial: our analysis is based on the assumption that the least productive firms decide not to export.

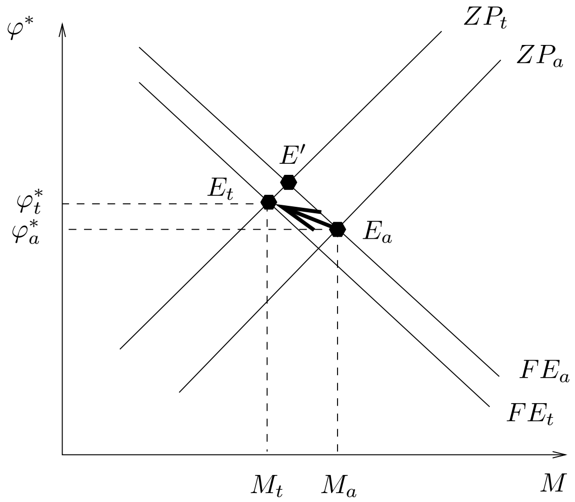

Figure 2: The impact of trade on the cutoff φ^* and the mass of active firms M.

Even though we are mainly interested in the long-run effect of the opening to trade, we can get some intuition by considering the short-run effect of an unexpected shift of the (ZP) curve. Just before this event, we are still at point E_a. When the change is announced, the low productivity firms realize that they will not be able to survive after the opening of trade. They thus exit, which decreases the mass of active firms.

3.4 Determination of the export cutoff

For an exporting firm, profits on the foreign markets are

$$n\pi_x(\varphi|\varphi_t^*, \varphi_x^*, M_t) = \frac{nR}{\sigma M_t} \frac{\tau^{1-\sigma}\varphi^{\sigma-1}}{\tilde{\varphi}(\varphi_t^*)^{\sigma-1} + p_x n \tau^{1-\sigma}\tilde{\varphi}(\varphi_x^*)^{\sigma-1}} - nf_x,$$

As these profits are increasing in φ, we must have

$$n\pi_x(\varphi_x^*|\varphi_t^*, \varphi_x^*, M_t) = \frac{nR}{\sigma M_t} \frac{\tau^{1-\sigma}\varphi_x^{*(\sigma-1)}}{\tilde{\varphi}(\varphi_t^*)^{\sigma-1} + p_x n \tau^{1-\sigma}\tilde{\varphi}(\varphi_x^*)^{\sigma-1}} - nf_x = 0$$

$$\Leftrightarrow f[k(\varphi_t^*)+1] + p_x n f_x[k(\varphi_x^*(\varphi_t^*))+1] = \frac{L}{\sigma M_t}.$$

This is the same equation as the one defining the zero-profit cutoff. Therefore, the system of equations that characterizes the open-economy equilibrium, (ZP_t and FE_t, with the latter given in Section 3.5), is similar to the one that characterizes the autarky equilibrium, (ZP_a and FE_a). The export productivity cutoff is simply given by $\varphi_x^*(\varphi_t^*) = \tau \left(\frac{f_x}{f}\right)^{\frac{1}{\sigma-1}} \varphi_t^*$.

3.5 The free-entry condition

For surviving firms, the conditional average profit is

$$\bar{\pi}_t(\varphi_t^*, \varphi_x^*, M_t) = \pi_d(\tilde{\varphi}(\varphi_t^*)|\varphi_t^*, \varphi_x^*, M_t) + p_x n \pi_x(\tilde{\varphi}(\varphi_x^*)|\varphi_t^*, \varphi_x^*, M_t).$$

We can find

$$\bar{\pi}_t(\varphi_t^*, \varphi_x^*, M_t) = \frac{L}{\sigma M_t} - f - p_x n f_x.$$

As long as $p_x n f_x > 0$, this implies

$$\bar{\pi}_t(\varphi^*, \varphi_x^*(\varphi^*), M) < \bar{\pi}_a(\varphi^{*'}, M), \forall (M, \varphi^*, \varphi^{*'}).$$

For any given M, trade liberalization leads to a lower average profit for the surviving firms: this is the *average-profit-reducing effect* of two-way trade. The fixed export costs f_x are also crucial here.

This result seemingly stands in stark contrast to the one in Melitz (2003) where it is shown that, for a given zero-profit cutoff φ^*, the average profit of surviving firms increases with trade. How can we reconcile the two results? Our analysis implies that the average profit increases after trade liberalization if the drop in the mass of surviving firms is sufficient; thus Melitz (2003) gets his result because, to keep any given zero-profit cutoff constant, the required drop in the mass of entering firms (thus in the mass of surviving firms) more than compensates for the new costs $p_x n f_x$.

Using $R = L$, the free-entry condition is

$$[1 - G(\varphi_t^*)]\frac{\bar{\pi}_t}{\delta} - f_e = 0 \Leftrightarrow \frac{L}{\sigma M_t} - f - p_x n f_x = \frac{\delta f_e}{1 - G(\varphi_t^*)}. \qquad (FE_t) \qquad (7)$$

Equations (3) and (7) imply that the (FE) curve shifts downward. As Figure 2 shows, the shift of the (FE) curve tends to mitigate the increase in φ^*.

To gain some intuition here, one can notice that point E' cannot describe a long-run equilibrium. Indeed, for E' to be a long-run equilibrium, the mass of firms entering the industry in each period has to be equal to $\frac{\delta M'}{1-G(\varphi')}$ (where M' and φ' are respectively the mass of firms and the productivity cutoff at E'). With such an entry, (only) the firms with a productivity $\varphi \geq \varphi'$ are able to survive. On the other hand, the net value of entry is negative, meaning that there should be less entry. This reduces the mass of active firms, which mitigates the increase in φ^*.

3.6 Equilibrium in the open economy

Equations (6) and (7) determine the equilibrium values of M_t and φ_t^*, represented by E_t in Figure 2. The zero-profit cutoff must satisfy

$$f[1 - G(\varphi_t^*)]k(\varphi_t^*) + n f_x[1 - G(\varphi_x^*(\varphi_t^*))]k(\varphi_x^*(\varphi_t^*)) = \delta f_e. \qquad (8)$$

The equilibrium exists and is unique (Melitz, 2003, Appendix C.2). Furthermore, equations (4) and (8) and Melitz (2003, Appendix B.1) imply $\varphi_t^* > \varphi_a^*$.

Furthermore, the mass of entering firms, $\frac{\delta M}{1-G(\varphi^*)}$, is lower in the equilibrium of the open economy than in the one of the closed economy. Indeed, the free-entry conditions (3) and (7) imply

$$\frac{M_a}{1-G(\varphi_a^*)} = \frac{L}{\sigma}\frac{1}{\delta f_e + f[1-G(\varphi_a^*)]};$$

$$\frac{M_t}{1-G(\varphi_t^*)} = \frac{L}{\sigma}\frac{1}{\delta f_e + f[1-G(\varphi_t^*)] + nf_x[1-G(\varphi_x^*)].}$$

There is less entry with trade if

$$f[1-G(\varphi_a^*)] \leq f[1-G(\varphi_t^*)] + nf_x[1-G(\varphi_x^*)].$$

But equations (4) and (8) imply together

$$f[1-G(\varphi_a^*)]k(\varphi_a^*) = f[1-G(\varphi_t^*)]k(\varphi_t^*) + nf_x[1-G(\varphi_x^*)]k(\varphi_x^*)$$

$$\Leftrightarrow f[1-G(\varphi_a^*)] = f[1-G(\varphi_t^*)]\frac{k(\varphi_t^*)}{k(\varphi_a^*)} + nf_x[1-G(\varphi_x^*)]\frac{k(\varphi_x^*)}{k(\varphi_a^*)}.$$

As we focus on equilibria with $\varphi_a^* < \varphi_t^* < \varphi_x^*$ and as $k(\varphi)$ is decreasing for the families of distributions mentioned in Melitz (2003), we get that, in the trading equilibrium, not only the mass of surviving firms is lower ($M_t < M_a$, as Figure 2 shows),[7] but the mass of entering firms is also lower. Generally, trade does not prompt entry.[8] This result is important in that it contradicts the intuition that moving from autarky to two-way trade raises the value of entry (because exporting opportunities are

[7]The proof that $M_t < M_a$ is very similar to the one in Melitz (2003). The free-entry conditions and $\varphi_t^* > \varphi_a^*$ imply together $\bar{\pi}_t > \bar{\pi}_a$. The average profit increases after the opening of trade because the total decrease in M more than compensates for the payment of the fixed export costs. From the equilibrium values of $\bar{\pi}_t$ and $\bar{\pi}_a$, we find $M_t = L/[\sigma(\bar{\pi}_t + f + p_x n f_x)]$ and $M_a = L/[\sigma(\bar{\pi}_a + f)]$. This leads to $M_t < M_a$.

[8]This result holds true in the case with homogeneous labor, as studied here. Introducing heterogeneity in factor endowments and factor intensities in Melitz's (2003) model, Bernard *et al.* (2007) show that trade might lead to more entry in the comparative advantage industries. In their numerical application, the total mass of entering firms remains constant when going from autarky to costly trade. This is so because the authors use a Pareto distribution for productivity: with this distribution, $k(\varphi)$ does not vary with φ.

created), thus the mass of firms entering the industry. For instance, it might be wrongly inferred from Melitz (2003, Section 7.2) and Bernard *et al.* (2007, Sections 1 and 5.1) that such an increase in the number of entrants contributes to an increase in competition on the labor (Melitz) or product (Bernard *et al.*) markets and thus to the selection effect of trade. As we have just proved, moving from autarky to two-way trade in the Melitz (2003) model generally reduces entry in the industry. It does raise product market competition, but the actual mechanism is that entry by foreign firms is not compensated by a "sufficient" reduction in the mass of active firms.

4 Conclusion

This paper analyzes the influential model of international trade with heterogeneous firms introduced by Melitz (2003). As the original work, our paper focuses on the effect of moving from autarky to two-way trade.

We study the effect of this trade liberalization with an intuitive, two-stage approach. Moving from autarky to costly trade, firms located in any country can export, but only if they pay a fixed export cost. This has two partial effects: a domestic-profit-reducing effect and an average-profit-reducing effect. Overall, moving from autarky to two-way trade raises product market competition (i.e. leads to a lower price index): the reduction in the mass of active firms is not sufficient to compensate for foreign market penetration by the most productive firms. This is crucial because this is what drives the bad firms out of the industry.

This increase in the degree of product market competition is not at center stage in the now standard approach proposed by Melitz. The problem with this standard approach is that it might induce a flawed reasoning. Indeed, starting from the fact that competition by foreign firms (in a model with imports only) is not sufficient to generate the selection effect of trade, one could conclude from Melitz (2003, Section 7.2) that it is not an increase in product market competition that drives the bad firms out, but rather an increase in labor market competition. As we have seen, this is inaccurate. Still with the standard approach, one might conclude that, due to the introduction of export opportunities, moving from autarky to two-way trade raises entry in the industry, which reinforces the selection effect of trade (through an increase in competition on the labor or product markets). We instead provide the new prediction that moving from autarky to two-way trade generally leads to less entry in the industry.

We hope that the intuitive approach presented in this paper clarifies those key interpretation issues in the important Melitz (2003) paper.

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